KNOWLEDGE EXPECTATIONS FOR PEST CONTROL ADVISERS: VERTEBRATE PEST MANAGEMENT

I. LAWS AND REGULATIONS

List the laws and regulations pertinent to vertebrate pest management.
(California Department of Fish and Game Code, Migratory Bird Treaty Act, Endangered Species Act, California Department of Food and Agriculture Administrative Code, County Interim Measures Bulletins, local ordinances)

Describe how different laws and regulations may pertain to the control of specific vertebrate pests and how they influence:
which species can be controlled;
the techniques or methods used;
the safeguards needed to protect nontarget species.

List the agency or agencies which enforce laws and regulations pertinent to vertebrate pest management.
(USEPA, US Fish and Wildlife Service, California Department of Fish and Game, California Department of Food and Agriculture, California Department of Pesticide Regulation, County Agricultural Commissioner, State Highway Patrol)

Describe how more than one law or regulation may apply to the control of the following pests:
ground squirrels;
tree squirrels;
crows.

Recognize that information on laws and regulations pertaining to vertebrate pest management can be found in the study guide.
(California Vertebrate Pest Control Handbook; Prevention and Control of Wildlife Damage, Volumes 1 and 2.)

Recognize the role of the County Agricultural Commissioner as the first source for site specific information regarding vertebrate pest management.

Recognize that pest control recommendations that violate the Endangered Species Act may result in criminal charges.

II. VERTEBRATE PEST ID

Be familiar with the following vertebrates and know which are pests. For pest species, understand their general biology and ecology and management tactics for their control.

Birds:
blackbirds
burrowing owls
cedar waxwings
cliff swallows
crowned sparrows
crows
egrets
geese
gold finches
gulls
herons
horned larks
house finches (linnets)
house sparrows
kingfishers
magpies
pheasants
pigeons
robins
scrub jays
starlings
terns
wild turkey
woodpeckers

Mammals:
bats
bears
beaver
bobcats
chipmunks
coyotes
deer
feral dogs
fox
marmots
moles

mountain lions
nutria
opossums
pocket gophers
porcupines
rabbits, hare
raccoons
skunks
wild pigs

Squirrels:
Belding's ground squirrel
fox tree squirrels
ground squirrels
tree squirrels

Rats and Mice:
cotton rats
muskrats
Norway rats
roof rats
wood rats
deer mice
house mice
meadow voles

Threatened and Endangered species:
blunt-nosed leopard lizards
Fresno kangaroo rats
giant kangaroo rats
Morro Bay kangaroo rats
salt marsh harvest mice
San Joaquin kit fox
Stephen's kangaroo rats
Tipton kangaroo rats

Define vertebrate pest.

Define fossorial and commensal.

Describe characteristics which make an animal a pest.
(high reproductive rate, high density-congregating behavior, propensity for feeding on crop, overabundance, value of crop being damaged, nuisance behaviors, vectors or reservoirs for disease)

A. Identification

Identify the major mammal pests in California agriculture.
(meadow voles, ground squirrels, deer, jack rabbits, pocket gophers, wild pigs, coyotes)

Identify the major bird pests in California agriculture.
(starlings, house sparrows, horned larks, jays, crows, crowned sparrows, gold finches, magpies, linnets, woodpecker, blackbirds, wild turkey, swallow, pigeon)

Describe ways in which the identity of a vertebrate pest might be confirmed.
(trapping, look for further signs such as tracks, droppings or hair, direct observations, location and patterns of damage, time of day that damage occurs)

List resources to assist in vertebrate pest identification.
(handbook, Peterson bird ID book, UC Publication 21385, Animal Tracks by O. J. Murie, Mammals of the Pacific States)

B. Pests and Crop or Environment Associations

List the vertebrate pests most commonly associated with the following agricultural crops:
strawberries (gold finches, ground squirrels, meadow voles);
grapes (starlings, pocket gophers);
sugarbeets (meadow voles, ground squirrels);
nut trees (crows, magpies, jays, pocket gophers, ground squirrels, tree squirrels);
deciduous fruit trees (meadow voles, pocket gophers, linnets, starlings);
citrus (meadow voles, roof rats, ground squirrels);
alfalfa (California and Belding's ground squirrels, pocket gophers, jack rabbits);
forage crops (ground squirrels, meadow voles);
tomatoes (meadow voles);
lettuce (horned larks);
rice (Norway rats, muskrats, blackbirds).

List the vertebrate pests that commonly cause problems in forestry.
(pocket gophers, deer, mountain beaver, rabbits, tree squirrels, porcupines)

List the vertebrate pests that commonly cause problems at cattle feedlots, dairies, and poultry and pork producing facilities.
(starlings, house sparrows, pigeons, blackbirds, Norway rats, roof rats, house mice)

List the predators responsible for major livestock losses in California.
(mountain lions, coyotes, dogs)

List the mammals that are often considered nuisance pests in suburban and urban environments.
(opossums, skunks, raccoons, bats, tree squirrels)

List the birds that are often considered nuisance pests in suburban and urban situations.
(geese, starlings, crows, swallows)

List the vertebrate pests that are considered of significance to public health.
(Norway rats, roof rats, bats, deer mice, ground squirrels, skunks)

List the vertebrates that are major pests of stored commodities and food processing facilities.
(Norway rats, roof rats, house mice, pigeons, house sparrows)

C. Distribution

Recognize that the following vertebrate pests are of limited distribution or occupy specific habitats:
- cotton rats;
- Belding's ground squirrels;
- mountain beavers;
- feral pigs;
- marmots.

D. Nature of Pest Damage

Recognize signs and symptoms used to identify damage caused by the following vertebrate pests:
- meadow voles;
- moles;
- ground squirrels;
- tree squirrels;
- deer;
- jack rabbits;
- house finches (linnets);
- horned larks;
- crows;
- pocket gophers;
- raccoons;

skunks;
wild pigs;
deer mice;
house mouse;
roof rat;
marmot;
cotton rat;
Norway rat;
wood rat;
muskrats.

List the vertebrate pests associated with the following damage symptoms:
girdling of trees—above ground;
girdling of trees—below ground;
vegetable seedling damage;
disbudding of deciduous fruit trees;
damage to ripening fruit;
damage to drip irrigation systems.

Differentiate between the types of damage caused by the following vertebrate pests:
mole and pocket gopher in turf;
pocket gophers and ground squirrels in field crops;
rodent and birds in seedling row crops;
carnivore and rodent damage to drip irrigation.

Recognize the bird pest and the damage or problem caused in:
aquaculture facilities (herons, gulls, terns, kingfishers);
buildings – nesting in or on (pigeons, swallows, house sparrows)

List the vertebrate pests that are associated with damage to levees and earthen dams.
(beaver, muskrat, ground squirrel, pocket gopher)

E. Native or Introduced Pests

Recognize that the following vertebrate pests are not native to California:
opossums;
starlings;
pigeons;
house sparrows;
house mice;
roof rats;
Norway rats;
fox tree squirrels.

III. VERTEBRATE PEST BIOLOGY AND ECOLOGY

A. Population Dynamics

Describe how vertebrate pest populations may be influenced by:

litter size;
number of litters per year;
cyclic population trends.

Describe how vertebrate pest populations may be limited by the following external factors:

food source and abundance;
shelter;
water;
predators/diseases.

B. Behavioral Characteristics

Describe how the following may influence management:

Hibernation/estivation;
dietary changes;
bait shyness;
neophobia;
cover or shelter;
activity patterns (diurnal/seasonal).

C. Habitats

Describe the natural habitats of the following pests:

meadow voles;
moles;
ground squirrels;
tree squirrels;
deer;
jack rabbits;
house finches (linnets);
horned larks;
rats.

Describe the visible differences between the burrows of the following vertebrate pests:

meadow voles;
moles;
pocket gophers;
ground squirrels;

Describe how to distinguish between an active and inactive burrow.

Describe how to determine if a ground squirrel burrow is being used by a target pest species or by one of the following nontarget species :

burrowing owl (white wash);
kit fox (key hole shape)

D. Disease Carriers

Identify the pest(s) most often associated with the following diseases:

plague (ground squirrels and chipmunks);
histoplasmosis (pigeons);
leptospirosis (rats);
hantavirus (deer mouse);
lyme disease (deer);
rabies (skunks and bats);
salmonellosis (rats and mice).

Identify the most common methods of human exposure for each of the following diseases:

plague;
histoplasmosis;
tularemia;
salmonellosis;
hantavirus;
lyme disease;
rabies.

Describe the importance of ectoparasite control:

when carrying out ground squirrel and chipmunk control in areas of high plague potential;
in association with commensal rodent control or bat exclusion.

IV. VERTEBRATE PEST MANAGEMENT

A. Assessing the Problem and Determining Strategies

Describe the steps taken to assess a vertebrate pest problem.

(ID species, location of damage, survey extent, severity and type of damage, trapping)

List the factors that must be considered in determining whether a control action should be taken.

(cost of control, efficacy of control, time of year, cost of damage and risk of future damage, environmental concerns, human health concerns)

Describe how the following short- and long-term solutions may differ and when each may be the best choice:

shooting deer vs. deer proof fence;

acute poison vs. habitat management for meadow voles.

Describe several key management options available for controlling the following vertebrate pests in nut crops:

ground squirrels;
crows;
meadow voles;
jays.

Describe how a combination of methods in an integrated pest management program would be used over time to manage:

ground squirrels;
meadow voles;
roof rats.

B. Environmental Management and Manipulation, Including Crop Cultural Practices

Describe how the following sanitation practices in urban situations can impact vertebrate pests:

food removal;
cleaning up rotten fruit;
removing bird feeders;
removing wood piles;
eliminating cover/ivy;
eliminating water sources;
eliminating bird nesting sites.

Describe the impact of the following cultural practices on vertebrate pests in crop situations:

irrigation methods;
crop type and variety;
field border sanitation;
cover crops;
tree row herbicide treatments;
burrow destruction;
crop rotation;
cultivation.

C. Exclusion

Describe how the following might be used to prevent damage or pest access:

deer fencing/exclusion fencing (deer);
electric fencing (coyotes, deer, raccoons, bears);
tree guards (rabbits, deer, voles, deer mice, rats);
netting (birds);
wire mesh planting baskets (gophers).

Recognize the importance of removing animals (and their progeny) from buildings before installing exclusion materials.
(bats, raccoons, skunks)

D. Frightening Methods

Describe how each of the following bird frightening devices or methods might best be used, alone or in combination, to temporarily protect orchard or vine crops from damage:
propane exploders;
reflective tapes;
eye balloons;
distress calls;
cracker shells;
electronic noisemakers.

Explain how habituation may influence the effectiveness of many frightening methods.

E. Trapping

List pests for which the following traps would be used:
modified Australian crow trap (starlings, linnets);
Macabee (gophers);
Out O' Sight (moles);
Havahart/cage-type live-traps (skunks, raccoons);
modified California-type box trap (ground squirrel);
Conibear-type trap (ground squirrels);
soft catch leghold traps (coyotes, fox);
harpoon (moles);
glue boards (house mouse).

Explain how CO_2 can be used to euthanize live trapped animals.

Recognize that translocation of vertebrate pests, such as ground squirrels, pocket gophers, and skunks is illegal according to California law.

F. Shooting and Hunting

List vertebrate pests that may be controlled by shooting or hunting.

Recognize that local fire arm restrictions may apply when using shooting or hunting to control vertebrate pests.

G. Chemical Repellents

Describe how chemical repellents deter vertebrate pests.

(tactile/sticky compounds make area unpleasant, by odor, by taste, combination of taste and odor)

List example of types of chemical repellents that are used against the following pests:
pigeons;
deer;
rabbits;
geese.

Explain why the usefulness and effectiveness of sticky type repellents may be limited.
(time consuming to apply, adversely affected by temperature, dust readily adheres to them; must be reapplied periodically, difficult to remove)

Explain why chemical repellents are not an effective long term solution for the control of deer.

H. Chemical Lethal Control

List the active ingredients registered as rodenticides, including burrow fumigants and predacides.
(strychnine; zinc phosphide; burrow fumigants—aluminum phosphide, gas cartridges; anticoagulants—chlorophacinone, diphacinone, warfarin; predacides—sodium cyanide, sodium fluoroacetate)

Describe the characteristics, including the capabilities and limitations, of baits and burrow fumigants.

Understand primary and secondary poisoning. (Primary poisoning is the toxic effects of a substance on an organism that directly consumes the poison, whether it be the target organism or not. Secondary poisoning occurs when an organism comes in contact with and is poisoned by another organism that was poisoned; ex. a dog eats a poisoned rodent and gets sick).

Identify how the following items relate to specific rodenticides:
mode of action of anticoagulants;
effectiveness for various target pests;
potential for producing primary poisoning in nontarget species;
potential for secondary poisoning in nontarget species;
which have effective antidotes;
potential for producing 'bait shyness';
restricted or nonrestricted use category.

i. Baits

Describe how the following can influence effectiveness of a vertebrate pest control program using baits:
pre-baiting;

testing bait acceptance;
timing (seasonal) of baiting;
frequency of baiting;
bait shyness.

Name the rodenticides which are presently registered for baiting field rodents.
(bromethalin; cholecalciferol; second generation anticoagulants—bromadiolone, brodifacoum, difethialone)

Describe how the following procedures can help avoid primary or secondary poisoning of nontarget species:
the use of bait stations;
removal of rodent carcasses;
using the least toxic rodenticide;
use of traps instead of baits;
bait storage out of the reach of domestic animals.

Describe how the following conditions affect bait efficacy:
bad odors;
moldy;
insect infested;
age.

Describe the different methods used for applying rodent baits.
(burrow builder, broadcast, spot bait, bait station)

Identify situations that favor the use of the following rodent bait application methods:
bait boxes;
spot baiting;
mechanical broadcasting;
burrow builder.

List vertebrate pests where the use of paraffin baits might be utilized.
(Norway rats, pocket gophers, muskrats)

List the advantages of paraffin baits in vertebrate pest control.
(easily handled and stored, weather resistant, resistant to molds and insects, unattractive to birds)

List the reasons for using colored baits.
(required by law; helps identify treated vs. nontreated, birds are repelled by colors and rodents are color blind)

ii. Fumigants

Describe the appropriate application methods for the use of burrow fumigants.

Describe how the following factors may influence burrow fumigant effectiveness:

- soil moisture;
- soil texture;
- time of year;
- temperature.

I. Biological Control

In predator/prey relationships explain why the number of prey often determines the number of predators and not vice versa.

J. Environmental Considerations

Describe how a field assessment is made to determine if and which nontarget species including threatened and endangered species may be at risk.

Describe how the following are used to assist in safeguarding nontarget species:

- fumigation of active holes only;
- use of color-dyed baits;
- bait boxes with three-inch openings (exclude kit fox);
- elevated bait stations (exclude kangaroo rats);
- referencing county bulletins.

Describe how to find out which threatened and endangered species in the area of treatment might be at risk from rodent control.

(Fresno kangaroo rat; giant kangaroo rat; Morro Bay kangaroo rat; salt marsh harvest mouse; San Joaquin kit fox; Stephen's kangaroo rat; Tipton kangaroo rat; blunt-nosed leopard lizard)

K. Economic Evaluations and Considerations

List the economic factors to be considered in vertebrate pest control programs.

Describe how the cost of vertebrate pest control can be compared with the benefit of control.

Describe why benefits may have to be assessed for several years beyond the year of control.